

Status Report: Astra SPX

For less than \$10 million, here's transcontinental range at 470 knots true, while cruising in the low- to mid-forties.

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Late in 1995, Israel Aircraft Industries (IAI) plans to certify the Astra SPX, a \$9.402-million (B/CA equipped) airplane that will be capable of cruising at 470 knots across the United States. IAI says the SPX will be able to dash from White Plains to Los Angeles in 5+22 against 85-percent probability headwinds. That's up to an hour faster coast-to-coast than some mid-size business aircraft that typically cruise at 400 to 430 knots, according to Astra Jet Corporation (AJC), the firm that markets IAI business jets.

How important is such a speed advantage? Let's assume that you're in New York, and you have an 8 p.m. reservation for an important business dinner in Los Angeles. Slogging through road traffic, you finally arrive at your aircraft at Westchester County Airport (HPN) in White Plains, New York at 5:00 p.m. Can you make your dinner appointment? Only if your business aircraft can fly at jetliner speeds for 2,500 miles.

Roy E. Bergstrom, AJC's president, points out, "Airliners have been crossing the country at 0.80 Mach and faster for years." The long-range cruise speed of most mid-size business jets, however, is 0.68 to 0.72 Mach, according to Bergstrom. He claims the Astra SPX will be able to sustain 0.82 Mach from New York to Los Angeles—a 58- to 80-knot speed advantage over its competitors. Bergstrom also asserts that the SPX will fly at FL 410 or higher—above most weather and turbulence—for longer periods than do current production mid-size business aircraft.

About a half dozen or so business aircraft, mostly in the \$16-million to \$30-million range, can sprint from White Plains to Los Angeles in less than 5+30, enabling you to arrive in time for your dinner appointment, given the three-hour time zone change and statis-

tical probability headwinds. The Astra SPX will be one of the fastest business aircraft ever certified—regardless of price or size. It will have few serious competitors in a flat-out race from New York to Los Angeles, according to AJC. For example, the Gulfstream IVSP can make the trip in 5+19, its manufacturer says. Notably, AJC claims that no business aircraft with comparable speed will consume so little fuel.

Admittedly, the ultra-swift Citation X, with a cruise speed faster than 500 KTAS, will consistently beat the Astra SPX on such transcontinental routes by less than one half hour. The SPX, however, will have a decided advantage in acquisition cost and high-speed cruise fuel economy, AJC claims.

DESIGN HIGHLIGHTS

The Astra SPX shares its fuselage with the Astra SP, resulting in a comparatively small frontal area for aerodynamic efficiency, but no plethora of spaciousness inside the cabin. Yet the SPX's squared-oval shape makes the most of the available cabin cross section, thereby belying the tale told by the tape measure.

As AJC has dubbed it, the optional, factory-provided "long range" interior is being designed by Henry Dreyfuss Associates, a firm well-known for its creative aircraft interior designs, among its other architectural innovations. Dreyfuss plans to fit the cabin with six chairs in a club and one-half configuration, although the cabin will be certified for nine occupants. Compared to the SP's, the SPX's seat pitch will be increased for more legroom. Each passenger will have access to a folding work table. Sculptured side rails with annunciator switches will be installed, and the passenger service unit panels will smoothly blend in with the headliner. The radio-telephone

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will be mounted flush with the side wall. Enhanced lighting will be installed in the cabin and the full-width, aft lavatory.

In the forward section of the cabin, the top and bottom galley cabinets will be vertically separated to create more counter space, giving the impression of a longer cabin. Similar to the Astra SP, a 10-inch, full-color LCD screen will be mounted on the cockpit/cabin bulkhead for flight information or for use with a videotape player.

As a customer's option, the SPX also will be sold without an interior or in various stages of completion. AJC will provide an interior completion allowance for customers who prefer to install their own cabin furnishings.

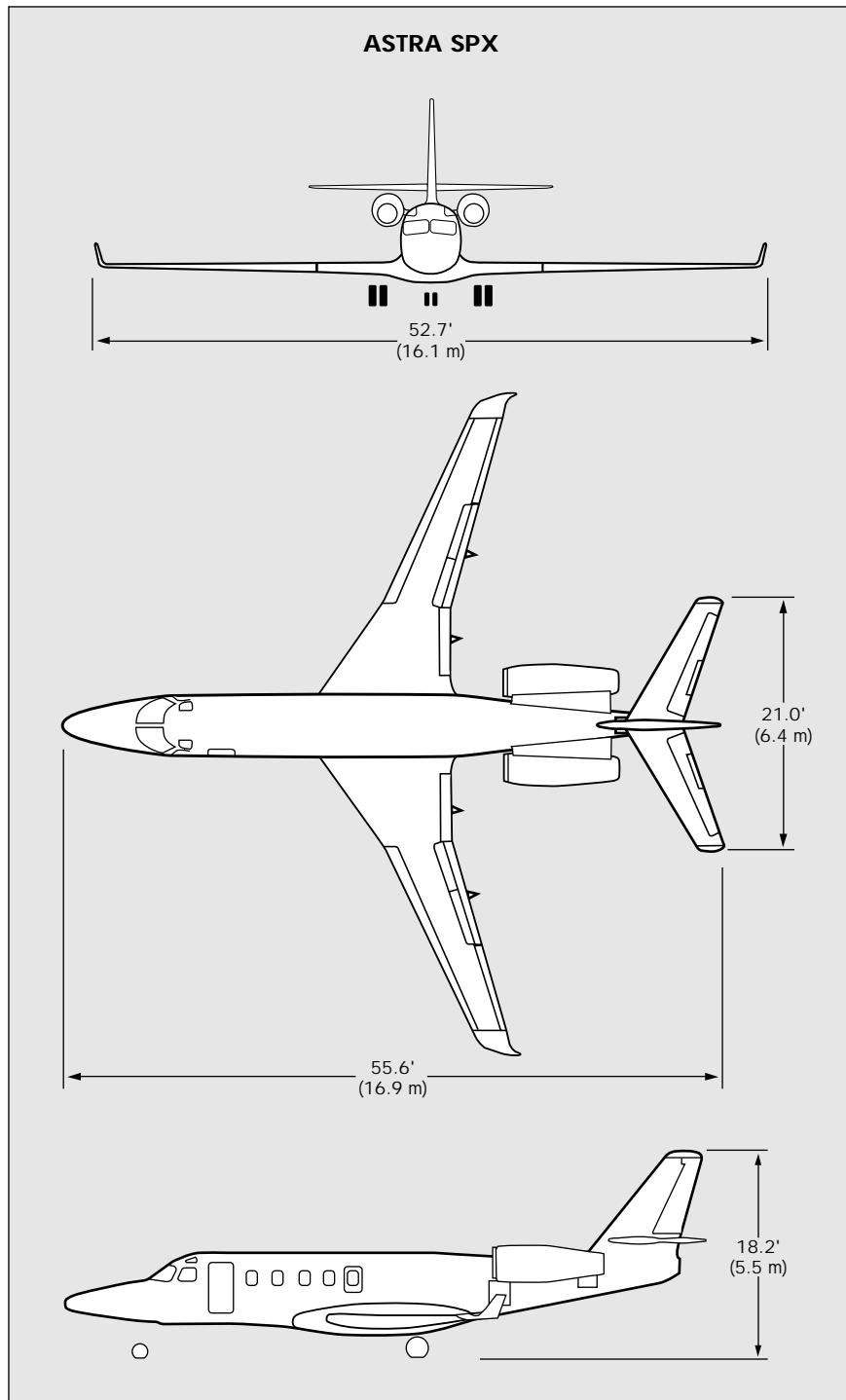
Wing modifications and evolutionary engine improvements in the SPX together produce 13- to 16-percent higher cruise efficiency compared to the Astra SP. The SPX uses that increase in efficiency to produce a 35-knot increase in cruise speed and a higher initial cruise altitude compared to the Astra SP.

The SPX shares its basic wing design with the Astra SP, but the SPX wing has been modified with winglets, adapted from the IAI Galaxy design. The SPX wing span is almost two feet longer than that of the SP. AJC claims that the wing modifications reduce drag by three to five percent.

AlliedSignal TFE731-40 turbofan engines are fitted to the SPX. (See sidebar.) Compared to the TFE731-3C engines on the Astra SP, the -40 turboprops yield 10 to 11 percent better specific fuel consumption, as well as produce higher thrust throughout the operating envelope.

PERFORMANCE CHARACTERISTICS

According to AJC, any mission that the SP can fly at 0.76 Mach, the Astra SPX will fly at 0.82 Mach with less than a four percent increase in fuel consumption.



For example, loaded with four passengers, the SP flies from White Plains to Los Angeles and cruises at 429 KTAS. Its initial cruise altitude is FL 350 (or FL 370, traffic permitting). After 93 minutes, the SP can

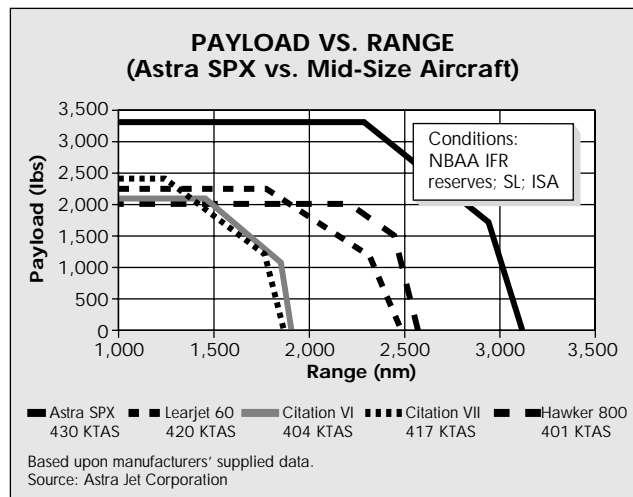
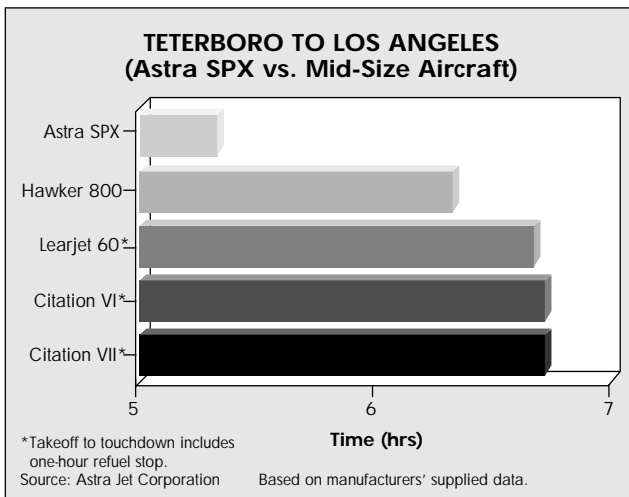
Collins Pro Line 4 Avionics Package

Like the SPX wing, the new airplane's Collins avionics suite comes from initial Galaxy design work. Both the SPX and the Galaxy will feature the latest Collins Pro Line 4 systems. The SPX crew will look at four identical 7.25-inch-square, integrated CRT display tubes—a primary flight display (PFD) and multi-function display (MFD) for each pilot. A flight control computer (FCC 4000 IAC) is at the heart of the system, supported by dual DADC 850C digital air data control systems and dual AHC 85C AHRS (attitude heading reference systems). Dual AlliedSignal (Global) GNS/ES FMSes have been selected as standard equipment to interface with the open-architecture Collins suite.

The weather radar is the WXR 850 solid-state turbulence detecting system. Split-scan radar is optional. CRT radio tuning units will control the dual Pro Line 400 series VHF navs, comms and TDR-94D Mode-S transponders. Triple comms and AHRS installations are included on the options list, as is the Collins TCAS II. Also, the system includes complete on-board automated maintenance and diagnostics.

In contrast with the SPX, the Galaxy cockpit will have one additional tube, an engine instruments and crew advisory system (EICAS) display, on the center panel between the pilots. This tube is identical to the PFDs and MFDs and can be interchanged. The unit has three pages—primary, secondary and electrical. Information presented includes engine parameters, aircraft system parameters, a collision avoidance system (CAS), Flight Data Acquisition Unit (FDAU) and aural alerts.

Astra Jet opted for avionics system commonality between the SPX and the Galaxy to provide synergies in operation, training, maintenance, manufacturing and support.



step-climb to FL 390. That results in a trip time of 5+54 and an overall fuel burn of 7,659 pounds for the trip, per AJC's computer.

In contrast, the SPX—with the same 800-pound payload—will be able to fly between HPN and LAX in 5+22, with an initial climb direct to FL 390 and a cruise speed of 470 KTAS. Its overall fuel burn for the trip will be 7,944 pounds, according to AJC's computer projections. In addition, the SPX's extra thrust helps to reduce its standard day, BFL at White Plains from 5,210 feet to 4,865 feet.

Slowing to a long-range cruise speed of 0.75 Mach (430 KTAS), the SPX has an NBAA IFR range of 3,025 nm with an 800-pound payload. Such range will

enable it to fly four passengers from Shannon to White Plains against 85 percent probability headwinds and land with NBAA IFR fuel reserves, a capability matched by very few other mid-size aircraft.

The SPX's high-speed cruise and long-range performance, however, is not obtained at the expense of fuel efficiency on shorter trips. On B/CA's 300-, 600- and 1,000-nm missions, the SPX will burn less fuel than any mid-size competitor, so say AJC performance projections.

In addition, the SPX wing has two-thirds span leading-edge slats and trailing-edge fowler flaps that give the aircraft excellent short-field performance, as shown by the accompanying charts.

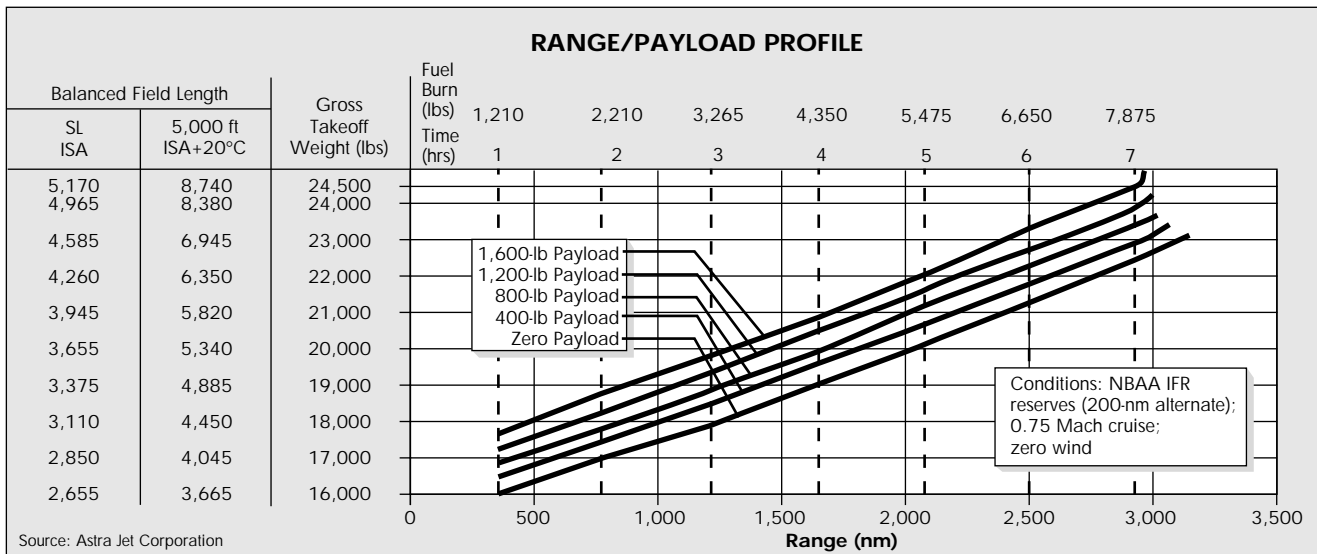
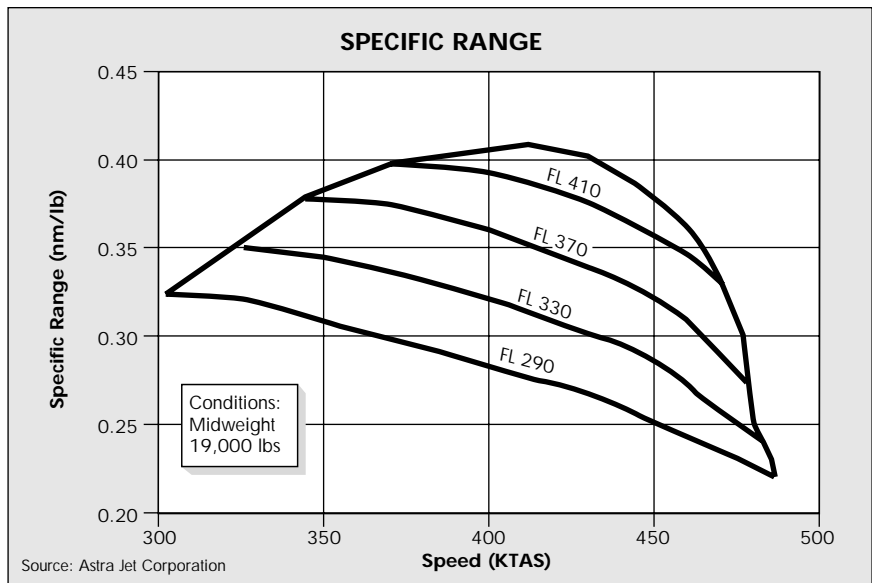
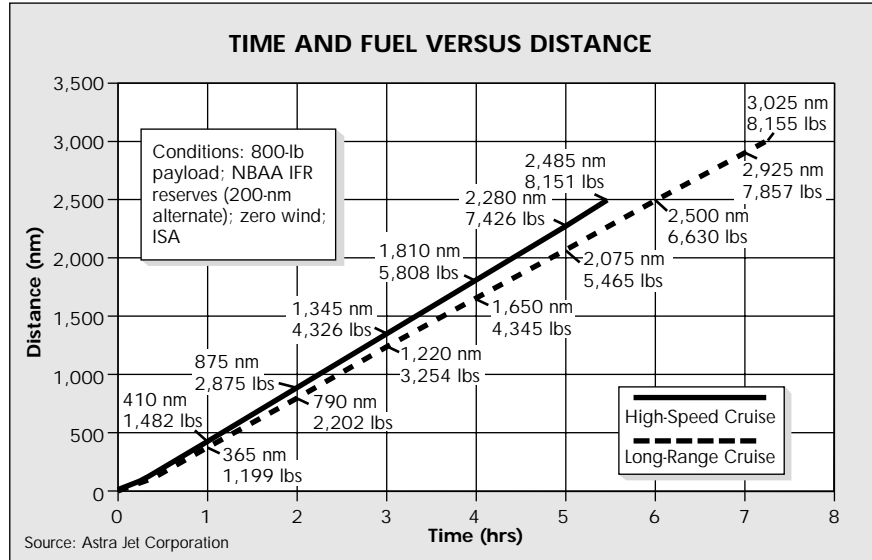
DEVELOPMENT AND CERTIFICATION

A production conforming prototype, the first Astra SPX initially flew in Israel on August 16—the official start of an ambitious flight-test program aimed at certification and production deliveries by the end of 1995. AJC claims that all test objectives were accomplished on the first flight, which lasted 4+25, including demonstrating the 0.82 Mach cruise speed at 44,000 feet. On subsequent summer flights, the SPX flew as fast as 0.92 Mach, putting the goal of a 0.87 Mmo well within reach.

The SPX made its public debut at Duncan Aviation in Lincoln, Nebraska on September 22 and was exhibited at the NBAA Convention in New Orleans. Then it was to spend two weeks at Collins Commercial Avionics in Cedar Rapids, Iowa for installation of the latest generation of Pro Line 4 integrated avionics. (See sidebar.)

In November, the aircraft is scheduled to return to Israel in preparation for the remainder of the flight-test program. During a break in the development program in mid-1995, AJC plans to display the SPX at the 1995 Paris Air Show. "The [computerized] flight data are so much better than we anticipated," Bergstrom allowed.

He told B/CA, "The risk in this program is almost nonexistent." The technology of the engines, avionics



AlliedSignal TFE731-40 Turbofan Engine

AlliedSignal Engines (ASE) will deliver complete engine pod assemblies, including Short Brothers composite nacelles, Dee Howard thrust reversers and computer-refined engine inlets, to IAI for mounting on the Astra SPX. As a result, ASE will be able to guarantee installed thrust and specific fuel consumption.

The Astra SPX will be the first aircraft to be powered by ASE's TFE731-40R, a 4,700-pound thermodynamic thrust engine that will be flat-rated to 4,250 pounds up to 24.4°C (76°F at sea level). Compared to the Astra SP, powered by 3,700-pound-thrust TFE731-3C engines, the Astra SPX will have nine percent better thrust-to-weight ratio at takeoff and slightly better fuel specifics at low altitude. Largely, this is due to the -40R's higher bypass ratio.

More importantly to business aircraft operators, the -40R puts out 20 percent more thrust at cruise altitude and squeezes 8.6 percent more thrust out of a pound of fuel. Compared to the -3C engine, the -40R has a one-third higher cycle pressure ratio because of improved compressor aerodynamics, tighter tolerances in the hot section and reduced air leakage through the seals. In addition, its fan—a scaled down version of the one in the -5B turbofan—produces a higher pressure ratio than the -3C engine.

ASE fits the engine with a single-channel, N₁ fan speed-referenced digital electronic engine control (DEEC) that provides most of the same functions as a full-authority digital engine control (FADEC) system, including engine synchronization and automatic performance reserve. The DEEC is mounted on the engine case, and it's backed up by a conventional hydro-mechanical fuel control unit.

Such low risk, evolutionary technology is the prime reason that the engine will enter service with a 2,100-hour major periodic inspection (MPI) interval and a 4,200-hour compressor zone inspection (CZI) interval. ASE expects the engine to reach mature levels of reliability early in the program. An accomplishment like this would permit MPI to be stretched to 2,500 hours and CZI to be lengthened to 5,000 hours, resulting in lower operating costs compared to the -3C engine, according to ASE. The engine is covered by a five-year, 2,000-hour non-prorated warranty

and systems has been well proven on previous aircraft. IAI believes only minor changes will be made to the design, such as the addition of pylon-mounted engine bleed-air intercoolers.

PRICE AND VALUE

IAI plans to co-produce the Astra SP, the Astra SPX and the Galaxy because the firm believes a separate market exists for each aircraft.

The manufacturer expects the SPX basic operating weight to be only 475 pounds heavier than the ultra-lean Astra SP, yet its maximum takeoff weight (MTOW) is 1,150 pounds greater, resulting in a 675-pound increase in useful load. The MTOW increase will allow the SPX to depart with full fuel, eight passengers and baggage, while still having 135 pounds in reserve for other needs. Indeed, few aircraft listed in B/CA's *Planning & Purchasing Handbook* have a useful load that is 81 percent of BOW, reflecting most favorably on IAI engineering expertise and a rigorous weight control regimen.

AJC's performance projections indicate that the slippery and powerful Astra SPX will offer more knots, a higher cruise altitude and more range per acquisition and operating cost dollar than most business aircraft. The Astra SPX, says AJC, will have lower operating costs than a Citation V Ultra.

If speed is what sells business aircraft to CEOs, and low operating costs are what sell business aircraft to CFOs, then the SPX should be a highly competitive aircraft. In addition, the SPX's runway performance results in the fastest trip times between a sizable number of airports having runways too short to accommodate much larger business aircraft with comparable speed—even if cost were no object.

When the Astra SPX is certified in late 1995, anybody in the market for a mid-size business jet will, for the first time, have access to an aircraft that can cruise at 470 knots. Even better, this new mid-size aircraft's relatively low operating costs should be as hard to match as its speed. **B/CA**